WHAT IS CLAIMED AS NEW AND DESIRED TO BE SECURED BY LETTERS PATENT OF THE UNITED STATES IS:

1. A dispersion compensator comprising:

at least one first optical waveguide;

a first slab waveguide;

an arrayed waveguide connected to said at least one first optical waveguide via said first slab waveguide, said arrayed waveguide comprising a plurality of channel waveguides each of which has a different length;

a second slab waveguide;

at least one second optical waveguide connected to said arrayed waveguide via said second slab waveguide; and

a phase distribution provider configured to provide a phase distribution to said arrayed waveguide.

2. A dispersion compensator according to Claim 1, wherein said phase distribution provider is configured to provide the phase distribution which is substantially symmetrical with respect to a center line among said plurality of channel waveguides.

3. A dispersion compensator according to Claim 1, wherein said phase distribution provider is configured to provide the phase distribution P(k) which substantially satisfies the following expression,

$$P(k) = A\{k - (M-1)/2\}^2 / \{(M-1)/2\}^2$$

where (A) is a coefficient, (M) is a number of said plurality of channel waveguides, and (k) identifies one of said plurality of channel waveguides and is from zero to (M-1).

4. A dispersion compensator according to Claim 1, wherein said phase distribution provider is configured to provide the phase distribution P(k) which substantially satisfies the following expression,

$$P(k) = A\{1 + \sin(-k\,\pi/M)\}$$

where (A) is a coefficient, (M) is a number of said plurality of channel waveguides, and (k) identifies one of said plurality of channel waveguides and is from zero to (M-1).

5. A dispersion compensator according to Claim 1, wherein said phase distribution provider is configured to provide the phase distribution P(k) which substantially satisfies the following expression,

$$P(k) = A\,(\exp[-\{k-(M-1)/2\}/4] + \exp[\{k-(M-1)/2\}/4])/[\exp\{(M-1)/8\} + \exp\{-(M-1)/8\}]$$

where (A) is a coefficient, (M) is a number of said plurality of channel waveguides, and (k) identifies one of said plurality of channel waveguides and is from zero to (M-1).

6. A dispersion compensator according to Claim 1, wherein said phase distribution provider is configured to provide the phase distribution P(k) which substantially satisfies the following expression,

$$P(k) = A\,|[-k/\{(M-1)/2\}] + 1|$$

where (A) is a coefficient, (M) is a number of said plurality of channel waveguides, and (k) identifies one of said plurality of channel waveguides and is from zero to (M-1).

7. A dispersion compensator according to Claim 1, wherein said phase distribution provider is configured to provide the phase distribution P(k) which is variable.

8. A dispersion compensator according to Claim 1, wherein said phase distribution provider comprises a refractive index adjuster which is configured to adjust a refractive index of each of said plurality of channel waveguides.

9. A dispersion compensator according to Claim 1, wherein said phase distribution provider comprises an heater configured to heat said plurality of channel waveguides.

10. A dispersion compensator according to Claim 9, wherein said heater is provided to be substantially symmetrical with respect to a center line among said plurality of channel waveguides.

11. A dispersion compensator according to Claim 9, wherein said heater extends along each of said plurality of channel waveguides, a maximum length (L) of said heater extending along each of said plurality of channel waveguides satisfies the following expression,

$$\Phi_{shift} = \{(2\pi/\lambda)(dn/dT)\Delta T\} L$$

where (Φ_{shift}) is a phase shift amount, (λ) is a wavelength, (n) is a refractive index of said channel waveguides, (T) is a temperature of said heater, (ΔT) is a temperature change of said heater.

12. A dispersion compensator according to Claim 9, wherein said heater comprises:

a first heater configured to function as a phase shifter for a positive dispersion compensation; and

a second heater configured to function as a phase shifter for a negative dispersion compensation.

13. A dispersion compensator according to Claim 12, wherein said first and second heaters are provided to be substantially symmetrical with respect to a center line among said plurality of channel waveguides.

14. A dispersion compensator according to Claim 13, wherein said first heater extends along each of said plurality of channel waveguides, a length of said first heater extending along each of said plurality of channel waveguides increasing toward the center line.

15. A dispersion compensator according to Claim 13, wherein said second heater extends along each of said plurality of channel waveguides, a length of said second heater extending along each of said plurality of channel waveguides decreasing toward the center line.

16. A dispersion compensator according to Claim 9, wherein said heater is an electrical heater.

17. A dispersion compensator according to Claim 16, wherein said heater is made of Cr, TiNi, or TaN.

18. A dispersion compensator according to Claim 16, further comprising:

an electric power supply controller configured to control electric power supply to said electrical heater to adjust the phase distribution.

19. A dispersion compensation system comprising:

a dispersion compensator comprising:

at least one first optical waveguide;

a first slab waveguide;

an arrayed waveguide connected to said at least one first optical waveguide via said first slab waveguide, said arrayed waveguide comprising a plurality of channel waveguides each of which has a different length;

a second slab waveguide;

at least one second optical waveguide connected to said arrayed waveguide via said second slab waveguide; and

phase distribution provider configured to provide a phase distribution to said arrayed waveguide; and

at least one dispersion compensation optical fiber connected to said at least one first optical waveguide or said at least one second optical waveguide.

20. A dispersion compensation system according to Claim 19, wherein said at least one dispersion compensation optical fiber carries out more than about 50% of dispersion compensation.

21. A dispersion compensation system according to Claim 20, wherein a dispersion compensation amount compensated by the dispersion compensator is at most ±100 psec/nm.

22. A dispersion compensation system according to Claim 20, wherein a ratio of a dispersion compensation amount compensated by said dispersion compensator to a dispersion compensation amount compensated by said at least one dispersion compensation optical fiber is from about 0.1 to about 0.35.

23. A method for manufacturing a dispersion compensator, comprising:

forming a circuit pattern on a core film, said circuit pattern comprising:

at least one first optical waveguide;

a first slab waveguide;

an arrayed waveguide connected to said at least one first optical waveguide via said first slab waveguide, said arrayed waveguide comprising a plurality of channel waveguides each of which has a different length;

a second slab waveguide;

at least one second optical waveguide connected to said arrayed waveguide via said second slab waveguide;

forming an over-clad film on said core film;

forming a heater on said over-clad film over said arrayed waveguide.

24. A method according to Claim 23, further comprising:

forming an under-clad film on a silicon substrate; and

forming a core film on said under clad-film.

25. A method according to Claim 24, the under-clad film and the core film are formed by using a flame hydrolysis deposition method.

26. A method according to Claim 23, the over-clad film is formed by using a flame hydrolysis deposition method.

27. A method according to Claim 23, the heater is formed by transferring a photomask pattern using a photolithography or a reactive ion etching.

28. A dispersion compensator comprising:

a substrate;

a circuit pattern formed on said substrate, said circuit pattern comprising:

at least one first optical waveguide;

a first slab waveguide;

an arrayed waveguide connected to said at least one first optical waveguide via said first slab waveguide, said arrayed waveguide comprising a plurality of channel waveguides each of which has a different length;

a second slab waveguide; and

at least one second optical waveguide connected to said arrayed waveguide via said second slab waveguide;

an over-clad film formed on said substrate to cover said circuit pattern; and

a phase distribution provider which is provided on said over-clad film over said arrayed waveguide and which is configured to provide a phase distribution to said arrayed waveguide.

29. A dispersion compensator according to Claim 28, wherein said substrate is a silicon substrate.

30. A dispersion compensator according to Claim 28, further comprising:

an under-clad film formed on the substrate; and

a core film which is formed on said under-clad film and on which said circuit pattern is formed.

31. A dispersion compensator according to Claim 28, wherein said phase distribution provider is configured to provide the phase distribution which is substantially symmetrical with respect to a center line among said plurality of channel waveguides.

32. A dispersion compensator according to Claim 28, wherein said phase distribution provider is configured to provide the phase distribution P(k) which substantially satisfies the following expression,

$$P(k) = A\{k - (M-1)/2\}^2 / \{(M-1)/2\}^2$$

where (A) is a coefficient, (M) is a number of said plurality of channel waveguides, and (k) identifies one of said plurality of channel waveguides and is from zero to (M-1).

33. A dispersion compensator according to Claim 28, wherein said phase distribution provider is configured to provide the phase distribution P(k) which substantially satisfies the following expression,

$$P(k) = A\{1 + \sin(-k\pi/M)\}$$

where (A) is a coefficient, (M) is a number of said plurality of channel waveguides, and (k) identifies one of said plurality of channel waveguides and is from zero to (M-1).

34. A dispersion compensator according to Claim 28, wherein said phase distribution provider is configured to provide the phase distribution P(k) which substantially satisfies the following expression,

$$P(k) = A\,(\exp[-\{k-(M-1)/2\}/4] + \exp[\{k-(M-1)/2\}/4])/[\exp\{(M-1)/8\} + \exp\{-(M-1)/8\}]$$

where (A) is a coefficient, (M) is a number of said plurality of channel waveguides, and (k) identifies one of said plurality of channel waveguides and is from zero to (M-1).

35. A dispersion compensator according to Claim 28, wherein said phase distribution provider is configured to provide the phase distribution P(k) which substantially satisfies the following expression,

$$P(k) = A\,|[-k/\{(M-1)/2\}] + 1|$$

where (A) is a coefficient, (M) is a number of said plurality of channel waveguides, and (k) identifies one of said plurality of channel waveguides and is from zero to (M-1).

36. A dispersion compensator according to Claim 28, wherein said phase distribution provider is configured to provide the phase distribution P(k) which is variable.

37. A dispersion compensator according to Claim 28, wherein said phase distribution provider comprises a refractive index adjuster which is configured to adjust a refractive index of each of said plurality of channel waveguides.

38. A dispersion compensator according to Claim 28, wherein said phase distribution provider comprises an heater configured to heat said plurality of channel waveguides.

39. A dispersion compensator according to Claim 38, wherein said heater is provided to be substantially symmetrical with respect to a center line among said plurality of channel waveguides.

40. A dispersion compensator according to Claim 38, wherein said heater extends along each of said plurality of channel waveguides, a maximum length (L) of said heater extending along each of said plurality of channel waveguides satisfies the following expression,

$$\Phi_{shift} = \{(2\pi/\lambda)(dn/dT)\Delta T\} L$$

where (Φ_{shift}) is a phase shift amount, (λ) is a wavelength, (n) is a refractive index of said channel waveguides, (T) is a temperature of said heater, (ΔT) is a temperature change of said heater.

41. A dispersion compensator according to Claim 38, wherein said heater comprises:

a first heater configured to function as a phase shifter for a positive dispersion compensation; and

a second heater configured to function as a phase shifter for a negative dispersion compensation.

42. A dispersion compensator according to Claim 41, wherein said first and second heaters are provided to be substantially symmetrical with respect to a center line among said plurality of channel waveguides.

43. A dispersion compensator according to Claim 42, wherein said first heater extends along each of said plurality of channel waveguides, a length of said first heater extending along each of said plurality of channel waveguides increasing toward the center line.

44. A dispersion compensator according to Claim 42, wherein said second heater extends along each of said plurality of channel waveguides, a length of said second heater extending along each of said plurality of channel waveguides decreasing toward the center line.

45. A dispersion compensator according to Claim 38, wherein said heater is an electrical heater.

46. A dispersion compensator according to Claim 45, wherein said heater is made of Cr, TiNi, or TaN.

47. A dispersion compensator according to Claim 45, further comprising:

an electric power supply controller configured to control electric power supply to said electrical heater to adjust the phase distribution.

48. A method for compensating wavelength dispersion in an optical transmission path, comprising:

providing a dispersion compensator comprising:

at least one first optical waveguide;

a first slab waveguide;

an arrayed waveguide connected to said at least one first optical waveguide via said first slab waveguide, said arrayed waveguide comprising a plurality of channel waveguides each of which has a different length;

a second slab waveguide;

at least one second optical waveguide connected to said arrayed waveguide via said second slab waveguide; and

providing a phase distribution to said arrayed waveguide.

49. A dispersion compensator comprising:

at least one first optical waveguide;

a first slab waveguide;

an arrayed waveguide connected to said at least one first optical waveguide via said first slab waveguide, said arrayed waveguide comprising a plurality of channel waveguides each of which has a different length;

a second slab waveguide;

at least one second optical waveguide connected to said arrayed waveguide via said second slab waveguide; and

phase distribution providing means for providing a phase distribution to said arrayed waveguide.

50. A method according to Claim 23, the circuit pattern is formed by transferring a photomask circuit pattern using a photolithography or a reactive ion etching.